Notes from Stakeholder Workshop 3

WRIA 9 Stormwater Retrofit Plan

April 25, 2013, Tukwila Community Center

Introductions

Tamie Kellogg (facilitator) did the following:

- Introduced the topic of today's workshop: receiving input on modeling assumptions and progress to date on the retrofit plan.
- Asked people at each table to introduce themselves.
- Introduced the speakers, the project team, and people working on other stormwater retrofit projects.
- Reviewed the format of the workshop (presentations and table discussions with facilitators at each table).
- Pointed out that there were displays of project milestones around the room and that project team members would be posted at each one to answer questions during breaks
- Summarized upcoming tasks and said that a final report would be completed this fall.

Update on Project Approach and Status

Jim Simmonds of King County presented an overview of the project. Highlights of the presentation are as follows:

- The project is funded by a grant from EPA and matching funds from King County, University of Washington (UW), and the Cities of Auburn, Covington, and Sea Tac. The Washington State Department of Ecology (Ecology) is contributing staff time.
- Stormwater retrofits are defined as construction projects to control stormwater in developed locations that are not part of redevelopment.
- Stormwater control in the Puget Sound area could cost an estimated $3–15 billion.
- The focus of the project is on streams in WRIA 9. Some areas are not included: Seattle, headwaters of Howard Hanson Dam, and Vashon Island. High pulse count (one of the modeling indicators) is greater in urbanized streams.
- Stakeholder input is an important part of the project. The team has incorporated input from the first two workshops. Another workshop will be held later in the year to present the results of the modeling. Other opportunities to provide input include draft project reports, email updates, and the WRIA 9 Watershed Ecosystem Form.
- The reports on (1) flow and water quality indicators and targets and (2) the SUSTAIN model pilot study are posted on the website (http://www.kingcounty.gov/environment/watersheds/green-river/stormwater-retrofit-project.aspx). Comments are due by May 8. Stakeholders will be notified when the draft HSPF modeling report (sometime this spring) and the draft SUSTAIN modeling report and WRIA retrofit options analysis (late summer or fall) are ready. Late this year, the final SUSTAIN report and options analysis will be completed and a retrofitting cost estimate for Puget Sound will be ready.

Flow and Water Quality Indicators and Targets for Assessing Watershed Goals

Dr. Richard Horner described how the team is using ranges of targets for interpreting model outputs:

- SUSTAIN is being used to identify the most effective and cost-effective stormwater management strategies (combinations of best management practices [BMPs] for various land uses and soils). Numerical targets are set for indictors to meet a range of possible aquatic biological goals (to sustain no further losses of biological integrity and to implement selected enhancements to restore some lost resources).
- Indictors are as follows:
    - Three hydrologic indicators: high pulse count (HPC), high pulse rate (HPR), and two-year peak mean winter base flow ratio (PEAK:BASE)
    - Water quality indicators: total suspended solids (TSS); total and dissolved metals (copper and zinc) and turbidity, for which there are state water quality criteria, are extrapolated through statistical relationships with TSS
    - Biological indicator: benthic index of biotic integrity (B-IBI)
- Using King County and University of Washington stream data, targets were set for hydrologic indicators to see how they statistically relate to set values (goals) for specific B-IBI scores (linear regression) and/or ranges of B-IBI scores (logistic regression) as percentages of the maximum B-IBI score. For example, to keep a B-IBI score above 32 percent of the maximum, an HPC of 15 must be achieved. Probabilities for reaching goals for each target are calculated.
- SUSTAIN produces a set of BMP strategies and costs to achieve a range of possible hydrologic and biological outcomes with estimated TSS concentrations. Statistical analysis based on data collected in the Green River watershed predicts the risk of exceeding water quality criteria for turbidity, copper, and zinc. These methods should not be used to predict specific concentrations of metals, only for assessing risks and only in WRIA 9 streams. Future changes could alter the relationship of TSS and other pollutants.

Questions:

- Q: Are both high pulse indicators highly correlated? Why have three hydrologic indicators?
  A: Using all three adds more information, but we could have discarded high pulse range.
- Q: Does the King County database make a distinction between wet and dry weather?
  A: The database includes information for both types of weather. We looked at both in the SUSTAIN analysis.
- Q: Which indicators correlated best with B-IBI?
  A: High pulse indicators correlated best. SUSTAIN had to be modified to accommodate the indicators.

SUSTAIN Modeling Assumptions

Curtis DeGasperi of King County described the SUSTAIN model and the assumptions regarding BMPs used in the model:

- SUSTAIN (System for Urban Stormwater Treatment and Analysis Integration) was developed by EPA. It is an ArcGIS-based framework that supports evaluation and decision-making regarding the effectiveness of green and gray BMPs in reducing runoff and pollutant loadings and identifying the most cost-effective BMP options to meet specified water quantity and quality objectives. (For this study, the output will be the most effective (in terms of reduction of HPC) and cost effective stormwater treatment trains.)
- The model is scalable from 10s to 1,000s of BMPs (not designed for simulation at the level of individual houses, roads, or parking lots). It works at the catchment level, routing flows to a

specific number of BMPs. We will scale up from the pilot catchment area to the whole watershed and then to the Puget Sound basin.

- Output is based on the following data: land use/land cover map, stream network and HSPF watershed models, instream targets, and BMP types, design configurations, and costs. We are seeking input on BMP design and cost assumptions at this workshop today.
- SUSTAIN works on an "aggregate" BMP approach. Two types of treatment trains that link BMPs to land uses are being used in the analysis: natural drainage (green) and natural drainage plus gray infrastructure (green + gray). Trains include onsite interception, onsite treatment, routing attenuation, and regional storage/treatment.
- Assumptions, including cost assumptions, were developed for the following BMPs: rain barrels, cisterns, rain gardens, porous pavement, and detention ponds. The assumptions vary depending on land use (agriculture, light urban, medium urban, heavy urban, transportation, and forest). (A table that lists the assumptions was distributed to participants.)

(People at each table discussed and provided feedback on Question 1—What's your input on the key assumptions for BMPs? See attached a summary of the comments received.)

SUSTAIN Model Results for Newaukum

Curtis described the outcomes of the SUSTAIN pilot study of the Newaukum urban sub-basin:

- The Newaukum urban sub-basin was selected to pilot the SUSTAIN approach and assumptions because data were available from the County's Green-Duwamish River Watershed Quality Assessment. The basin is 230 acres, with established flow and water quality monitoring points.
- UW GIS students piloted a method to estimate rooftop and commercial parking area output.
- SUSTAIN considers the BMP aquifer (water infiltrated via BMPs), the aquifer from pervious surfaces not captured by BMPs (slower release to the aquifer), and evaporation. Water from both aquifers reaches the assessment point.
- It was assumed that the sub-basin is dominated by till, with some poorly drained Type D soils. For till areas, a numerical value based on HPC data and an aquifer recession coefficient (/hr) were assigned to each BMP. An underdrain was assumed for Type D soils. Limited analysis was done for Type D areas, with fewer scenarios, because there was no aquifer coefficient.
- The analysis found that a variety of BMP combinations can meet similar targets at a variety of costs and that green + gray scenarios show similar effectiveness but are less costly than green only scenarios. The most effective/cost-effective of all scenarios was Scenario 15, a combination of cisterns, rain gardens, roadside and onsite bioretention, and detention ponds. The model output indicates that this scenario has a zero aquifer coefficient and about a 55 percent HPC reduction, 52 percent of maximum B-IBI (relating HPC to B-IBI), and 80 percent reduction in TSS (and extrapolated reductions in turbidity, copper, and zinc).
- Overall, effectiveness greatly depends on the assumptions regarding the fate of BMP infiltration.
- Recommendation: extend the analysis to a number of other catchments with relatively homogeneous land use/land cover.

Questions:

- Q: Do you get more effective treatment by just spending more money?
  A: Higher costs do not always result in more effectiveness. Our results show some combinations of BMPs are more expensive but result in less treatment.
- Q: What other variables were used regarding land use and soils?
  A: The catchment was largely homogeneous. Some commercial/industrial was considered, but this catchment was chosen because of its homogeneity.
- Q: Was construction feasibility considered in this assessment?

A: Feasibility, such as whether people would install rain gardens, was not considered. This is a high-level analysis. The effectiveness percent would need to be tested.

(People at each table discussed and provided feedback on Question 2—What's your input on the how to summarize and share model output? See attached a summary of the comments received)

Approach to Scaling Up to the Watershed

Curtis described the preliminary approach to scaling up the modeling to the watershed:

- It is not possible to model every square mile of WRIA 9. Instead, the team would model 12 representative catchments, representing a variety of homogeneous areas in terms of land use and physiographic characteristics that influence selection of BMPs. The assumptions and 16 treatment trains would be applied, similar to the Newaukum pilot. Then, they would scale up to all of WRIA 9. (L.A. County did something similar.)

Questions:

- Q: Will you look at soil type, not just land use categories?
  A: Yes, we need to include soils in selecting areas.
- Q: Will slope stability be considered?
  A: No, that is a feasibility issue, whether infiltration will increase instability.
- Q: Can you combine results for all areas to apply to various combinations of conditions?
  A: Probably not. We will break down information by land use but will not produce full cost-effectiveness curves. We will make recommendations only for the basins modeled. We are not looking at the current low-impact development in basins.

(People at each table discussed and provided feedback on Question 3—What's your input on the approach to scaling up SUSTAIN modeling to all of WRIA 9? See summary of comments.)

Update on Independent Retrofit Modeling of Newaukum

Olivia Wright, a recently matriculated masters student at UW, described results of running an ecohydrology model on the Newaukum urban catchment:

- The purpose of the model is to determine the most effective size and treatment area for bioretention facilities. It assumes standard bioretention design, cells distributed throughout a catchment, and location of bioretention in pervious areas adjacent to impervious surfaces.
- Outcome for the Newaukum catchment are as follows:
  - Threshold of effectiveness for indicator reduction in each treatment area scenario.
  - Maximum improvement with 10-foot x10-foot bioretention cells.
  - The best B-IBI estimates achieved HPC target with minimum of 40 percent treatment.
  - An 80 percent confidence interval with low B-IBI estimates did not meet HPC targets.
  - Bioretention alone is insufficient to meet HPR targets.
  - Need large amount of treatment for significant improvement.

Updates on Related Projects

- Mindy Roberts (Ecology) presented information on a case study of a small watershed in Federal Way to evaluate whether SUSTAIN is an appropriate tool for prioritizing stormwater management strategies small watersheds. She mentioned a few information gaps, such as BMP costs and removal efficiencies, and limitations of the model, such as long runtimes and allowing for only one aggregated BMP per basin.
- Dino Marshalonis described a project that is using SUSTAIN to evaluate how to handle future development, in a small representative catchment (Gorst Creek basin in Bremerton area).

- Tracy Tackett talked of the Piper's Creek project, a part of the Seattle flow control plan. They used SUSTAIN to alter the flow regime and are working with EPA to modify the scope to examine more model runs using SWMM for the low impact development. They are waiting to install BMPs.

Next Steps

Tamie closed by reminding participants to comment on the indicators/targets and Newaukum pilot study reports by May 8, that the HSPF report will be posted soon, and that the final workshop will be held sometime this fall to share the results of the modeling.